

Surface Investigations of Tungstophosphoric Acid, $\text{H}_3\text{PW}_{12}\text{O}_{40}$, Supported on MCM-41 Mesoporous Silica Catalyst

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Abstract

A catalyst system of large pore size, such as supported acid on MCM-41, could be more suitable for reactions involving bulk size molecules. The pore size could range from 2.0 to 50 nm. All-silica MCM-41 is not acidic material. However, an acid could be impregnated in MCM-41 to make the surface acidic. Due to its super acidity, tungstophosphoric acid (HPW) was chosen to be impregnated in MCM-41. The surface properties and the stability of the new system are important factors to know for determining what kind of reactions could be used with these systems.

High resolution XPS showed a shift of the W 4f peak towards the higher binding energy after heating the acid under air at 200 °C and 400 °C. This shift was associated with a decrease of the O 1s binding energy. These results suggest the formation of higher oxidation states of the W atom in the Keggin structure of the HPW acid. In addition, the W 4f_{7/2} and W 4f_{5/2} spin-orbit split doublet was not resolved as a result of a drastic broadening of the peaks. This indicates that the impregnation destabilizes the supported acid that may affect its chemical activity.

X-ray absorption near edge structures (XANES) of the W N₃-edge, O K-edge and Si L_{2,3}-edge were also investigated as a function of temperature. The results will be discussed.

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